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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/909,998	07/23/2001	Sajeev John	13727	1419

7590 09/25/2002
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EXAMINER

CHOI, WILLIAM C

ART UNIT PAPER NUMBER

2873

DATE MAILED: 09/25/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/909,998

Applicant(s)

JOHN ET AL.

Examiner

William C. Choi

Art Unit

2873

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-69 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-20, 36, 38-67 and 69 is/are rejected.
- 7) ☒ Claim(s) 21-35, 37 and 68 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 July 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). ____
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____ 6) ☐ Other: ____

DETAILED ACTION

Priority

Applicant's claim for domestic priority under 35 U.S.C. 119(e) is acknowledged.

Drawings

This application has been filed with informal drawings, which are acceptable for examination purposes only. Formal drawings will be required when the application is allowed.

Claim Objections

Claims 66-68 are objected to because of the following informalities: In regards to these claims, "according to claim" in line 1 of each respective claim should be changed to "according to the method of claim" in order to agree with the method claim 62.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 39 (and dependent claims 40-51 and 53-61), 64 (and dependent claim 65) and 69 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the first dielectric constituent to be optically anisotropic, does

Art Unit: 2873

not reasonably provide enablement for the refractive index properties of said first dielectric constituent to be changeable when said second dielectric constituent is air or a dielectric solid material. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims. Applicant sets forth examples in the specification, which discloses the use of anisotropic semiconductors as the backbone of the photonic crystal. However, it is not clearly disclosed as to which of these materials has a changeable refractive index when air or a dielectric solid material serves as the second dielectric constituent, while having said second index of refraction less than that of the first said constituent.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1-2, 4-5, 7-8, 11 and 62 are rejected under 35 U.S.C. 102(e) as being anticipated by Burt et al.

In regards to claims 1 and 62, Burt et al discloses a photonic crystal (column 2, line 50) having a tunable photonic band structure (column 1, lines 54-64 and column 2, lines 65-67), comprising; a periodic composite dielectric material having at least two dielectric constituents including a first dielectric constituent having a first refractive index and a second dielectric constituent having a second refractive index (column 2, lines 50-51) inherently having one refractive index smaller than the other, so that the periodic composite dielectric material has a photonic band structure (column 1, lines 48-64); and at least one of said at least two dielectric constituents having refractive index properties which can be locally or globally changed throughout said photonic crystal in a controlled manner (column 2, lines 59-64) whereby changing the refractive index properties modulates said photonic band structure locally or globally throughout said photonic crystal (column 2, lines 65-67).

Regarding claim 2, Burt et al discloses wherein said periodic composite dielectric material includes periodic void regions throughout a volume of said periodic composite dielectric material (Abstract and column 2, lines 52-53, Figure 5, "H").

Regarding claims 4 and 5, Burt et al discloses wherein said periodic composite dielectric structure includes a photonic bandgap which is tunable (column 2, lines 65-67), which inherently would be complete, this being reasonably assumed from Burt et al disclosing said invention comprising an Indium Phosphide substrate (Abstract) and a second variable refractive index dielectric component (column 2, lines 59-61).

Regarding claims 7 and 8, Burt et al discloses wherein said first dielectric constituent is a semiconductor (Abstract and Figure 5, "InP").

Regarding claim 11, Burt et al discloses wherein said at least one of the at least two dielectric constituents having refractive index properties which can be globally or locally changed includes a dielectric constituent having optical anisotropy infiltrated into said void regions (column 5, lines 56-59, re liquid crystal), and wherein said optical anisotropy is controlled by application of one of an electric, magnetic and electromagnetic field (column 5, lines 56-62).

Claims 38 and 52 are rejected under 35 U.S.C. 102(e) as being anticipated by Burt et al.

In regards to claim 38, Burt et al discloses a photonic crystal (column 2, line 50) having a tunable photonic band structure (column 1, lines 54-64 and column 2, lines 65-67), comprising; a periodic composite dielectric material having a first dielectric constituent having a first refractive index (Figure 6, "InP") and void regions located periodically throughout a volume of said periodic composite dielectric material (column 5, lines 52-54, Figure 6), a second dielectric constituent located in said void regions (column 5, lines 52-65) inherently having a second refractive index sufficiently smaller than the first refractive index so that the periodic composite and dielectric material has a photonic band structure, this being reasonably assumed from Burt et al disclosing said invention being tunable (column 5, lines 56-62), at least one of said first and second dielectric constituents being optically anisotropic and having refractive index properties which can be locally or globally modified in a controlled manner (column 2, lines 59-64,

Art Unit: 2873

re liquid crystal) whereby changing the refractive index properties inherently changes said photonic band structure (column 2, lines 65-67 and column 5, lines 59-62).

Regarding claim 52, Burt et al discloses wherein said first dielectric constituent is a semiconductor is selected from the group consisting of Si, Ge, SiC, AlP, AIS, AsSb, GaP, GaAs, GaSb, InP, InAs, InSb, ZnO, ZnSe, CdSe and HgS (Figure 6, "InP"), and wherein said periodic composite dielectric material would inherently have at least one complete photonic band gap which is tunable, this being reasonably assumed from Burt et al disclosing said material being either a liquid crystal or any strong nonlinear optical semiconductor (column 5, lines 56-65).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3, 6, 9, 10, 12-20, 36, 63, 66 and 67 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burt et al as applied to claims 2 and 62 above, and further in view of Zakhidov et al.

In regards to claims 3 and 63, Burt et al discloses as set forth above but does not specifically disclose wherein said periodic composite dielectric material is an inverted opal wherein said void regions are overlapping air spheres formed in a face centered cubic lattice. Within the field of endeavor, Zakhidov et al teaches a photonic crystal

Art Unit: 2873

(column 16, lines 53-63) formed in a face centered cubic lattice (column 7, lines 2-5, Figure 3) wherein said periodic composite dielectric material is an inverted opal (column 7, lines 9-13 and column 20, lines 9-10, Figure 3) wherein said void regions are overlapping air spheres (column 20, lines 9-12) for the purpose of maximizing diffraction efficiency (column 20, lines 13-15).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made for said composite dielectric material of Burt et al to comprise the limitations set forth above for the purpose of maximizing diffraction efficiency.

Regarding claim 6, Burt et al discloses wherein said periodic composite dielectric structure includes a photonic bandgap which is tunable (column 2, lines 65-67), which inherently would be complete, this being reasonably assumed from Burt et al disclosing said invention comprising an Indium Phosphide substrate (Abstract) and a second variable refractive index dielectric component (column 2, lines 59-61).

Regarding claims 9 and 10, Burt et al discloses wherein said first dielectric constituent is a semiconductor (Abstract and Figure 5, "InP").

Regarding claims 12-14, Burt et al discloses wherein said at least one of the at least two dielectric constituents having refractive index properties which can be globally or locally changed includes a dielectric constituent having optical anisotropy infiltrated into said void regions (column 5, lines 56-59, re liquid crystal), and wherein said optical anisotropy is controlled by application of one of an electric, magnetic and electromagnetic field (column 5, lines 56-62).

Art Unit: 2873

Regarding claims 15-17 and 66, Burt et al discloses wherein said dielectric constituent having optical anisotropy infiltrated into said void regions is selected from the group consisting of optically anisotropic compounds, ferroelectric materials exhibiting optical birefringence, and materials exhibiting Faraday activity (column 5, lines 56-62, re liquid crystal).

Regarding claims 18-20 and 67, Burt et al discloses wherein said optically anisotropic compounds are selected from the group consisting of liquid crystals (column 5, lines 56-62), which inherently would be selected from the group of nematic liquid crystals and chiral molecules including cholesteric liquid crystals, this being reasonably assumed from these groups comprising a large majority of liquid crystals.

Regarding claim 36, Burt et al discloses wherein said semiconductor is selected from the group consisting of Si, Ge, SiC, AlP, AlS, AsSb, GaP, GaAs, GaSb, InP, InAs, InSb, ZnO, ZnSe, CdSe and HgS (Figure 6, "InP").

Allowable Subject Matter

Claims 21-35, 37 and 68 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: in reference to the allowable claims, none of the prior art either alone or in combination disclose or teach of the claimed limitations to warrant a rejection under 35 USC 102 or 103.

The prior art fails to teach a combination of all the claimed features as presented in claims 21-30, 33-34 and 37: a photonic crystal wherein said optically anisotropic compounds is a nematic liquid crystal, and wherein said band structure is modulated either globally or locally by rotations of a nematic director field of the nematic liquid crystal by application of an external electric field.

The prior art fails to teach a combination of all the claimed features as presented in claims 31-32: a photonic crystal as claimed wherein the periodic composite dielectric material has a lattice periodicity ranging from about 0.28 microns to about 1.8 microns.

The prior art fails to teach a combination of all the claimed features as presented in claim 35: a photonic crystal as claimed wherein said at least one of said at least two dielectric constituents having refractive index properties which can be globally or locally changed includes said semiconductor having implanted therein with a sufficient concentration of magnetic ions to exhibit Faraday-activity, and wherein said refractive index properties are changed by application of a magnetic field.

The prior art fails to teach a combination of all the claimed features as presented in claim 68: a photonic crystal of claimed method wherein said optically anisotropic molecules is a nematic liquid crystal, and wherein said band structure is modulated either globally or locally by rotations of a nematic director field of the nematic liquid crystal by application of an external electric field globally to the entire photonic crystal or locally to preselected portions of said photonic crystal.

Art Unit: 2873

Conclusion

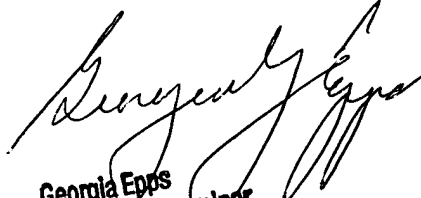
The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Fajardo et al and Fink et al are being cited herein to show photonic crystals that would read on or make obvious a number of the above rejected claims, however, such rejections would have been repetitive.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to William C. Choi whose telephone number is (703) 305-3100. The examiner can normally be reached on Monday-Friday from about 9:00 am to 6 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Georgia Y. Epps can be reached on (703) 308-4883. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3431 for regular communications and (703) 305-3432 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

W.C.
William Choi
Patent Examiner
Art Unit 2873
September 21, 2002


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